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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the application of:
HUI-JUNG WU, ET AL.

Docket: 30-4540

Serial Number: 09/141,287

Group Art Unit: 2800

Filed: August 27, 1998

Examiner: C. Bowers

For: PROCESS FOR OPTIMIZING MECHANICAL STRENGTH OF
NANOPOROUS SILICA

REPLY BRIEF FOR APPELLANT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

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This Reply Brief is submitted in response to the to the new points of argument raised in the Examiner's Answer mailed August 23, 2000. This Reply Brief is submitted in Triplicate.

The examiner has stated in his Answer that the Summary of the Invention in Appellants' appeal brief is deficient. Appellants submit that this is not the case, as this section of the brief correctly summarizes the amended claims. Appellants also submit that the Summary of the Invention in an appeal brief is not required to be an identical reproduction of the Summary of the Invention in the specification.

The examiner has also stated that he disagrees with Appellants' assertion of novelty in the Summary of the Invention. Appellants respectfully submit that this disagreement by the

examiner has no legal significance related to this appeal. Only the claims define the invention on appeal.

Appellants acknowledge the examiner's agreement that the rejection of claims 1-9 and 13-29 under 35 U.S.C. 102(e) in view of U.S. Patent No. 5,736,425 was withdrawn by the former examiner after the first office action. The prosecution chronicle of the pre-amended claims recited on page 5, section 11 (A) of the Examiner's Answer may be of historical interest, but they are irrelevant to the appealed claims. Appellants therefore submit that arguments against or in support of a withdrawn rejection are not necessary for purposes of this appeal.

The examiner has stated that the rejection of claims 1-9 and 13-29 stand or fall together, and that the rejection of claims 1-13 and 16-29 stand or fall together. The claims should be considered separately for the 35 U.S.C. 103 rejection, and for the obviousness-type double patenting rejection.

With regard to claim 1, the art does not show the stated monomethyl ethers.

With regard to claim 2, the art does not show the stated monomethyl ethers of claim 1 and additionally an organic solvent vapor atmosphere containing a relatively low volatility organic solvent which has a boiling point of about 175°C or higher.

With regard to claim 3, the art does not show the stated monomethyl ethers of claim 1 and additionally the specifically recited organic solvent vapor atmosphere.

With regard to claim 4, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the organic solvent composition of step (a) comprises the same organic solvent as in the organic solvent vapor atmosphere of step (b).

With regard to claim 5, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the solvent vapor atmosphere contains a relatively low volatility organic solvent which is present in the atmosphere in an amount of from about 50 to about 99.9 percent saturation.

With regard to claim 6, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the base catalyst is present in the alkoxysilane gel composition.

With regard to claim 7, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by exposing the alkoxysilane to the water in the form of water vapor.

With regard to claim 8, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by exposing the alkoxysilane to the base catalyst in the form of base vapor.

With regard to claim 9, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by exposing the alkoxysilane both to water in the form of water vapor and to the base catalyst in the form of base vapor.

With regard to claim 10, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by depositing the alkoxysilane and the organic solvent composition onto the substrate in the form of a stream.

With regard to claim 11, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by depositing the

alkoxysilane, the organic solvent composition, and the water onto the substrate in the form of a combined stream.

With regard to claim 12, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by depositing the alkoxysilane, the organic solvent composition, and the base catalyst onto the substrate in the form of a combined stream.

With regard to claim 13, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane gel composition is formed by depositing the alkoxysilane, the organic solvent composition, the water, and the base catalyst onto the substrate in the form of a combined stream.

With further regard to claims 11-13, the examiner also asserts that it is the responsibility of Appellant to provide compelling reasons as to why a "combined stream" is not obvious to one skilled in the art as a means for applying spin-on solutions. Appellants respectfully disagree with this assertion. Contrary to the examiner's assertion, it is the *examiner's* responsibility to provide reasons to Appellants as to why a combined stream *is* obvious to one skilled in the art. For the information of the Board, the United States Patent and Trademark Office (same primary examiner) has already determined that forming a nanoporous dielectric coating by depositing an alkoxysilane, organic solvent composition, and water onto a substrate in the form of a combined stream is non-obvious by granting U.S. patent 6,037,275 (filed on the same day as this application).

With regard to claim 16, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the relatively high volatility solvent comprises one or more components selected from the group consisting of methanol, ethanol, n-propanol, isopropanol, n-butanol and mixtures thereof and wherein the relatively low volatility solvent composition comprises an alcohol or a polyol.

With regard to claim 17, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the base catalyst is selected from the group consisting of ammonia, primary alkyl amines, secondary alkyl amines, tertiary alkyl amines, aryl amines, alcohol amines and mixtures thereof.

With regard to claim 18, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane has the indicated formula.

With regard to claim 19, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane has the indicated formula wherein each R is methoxy, ethoxy or propoxy.

With regard to claim 20, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the alkoxysilane composition comprises at least one organic solvent selected from the group consisting of methanol, ethanol, n-propanol, isopropanol, n-butanol, ethylene glycol, 1,4-butylene glycol, 1,5-pentanediol, 1,2,4-butanetriol, 1,2,3-butanetriol, 2-methyl-propanetriol, 2-(hydroxymethyl)-1,3-propanediol, 1,4,1,4-butanediol, 2-methyl-1,3-propanediol, tetraethylene glycol, triethylene glycol monomethyl ether, glycerol, and mixtures thereof.

With regard to claim 21, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the substrate comprises silicon or gallium arsenide.

With regard to claim 22, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the substrate comprises at least one semiconductor material.

With regard to claim 23, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the semiconductor material is selected from the group consisting of gallium arsenide, silicon, and compositions containing silicon, crystalline silicon,

polysilicon, amorphous silicon, epitaxial silicon, and silicon dioxide, and mixtures thereof.

With regard to claim 24, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the substrate has a pattern of lines on its surface.

With regard to claim 25, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the pattern of lines on its surface comprise a metal, an oxide, a nitride or an oxynitride.

With regard to claim 26, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the gel composition is cured by heating.

With regard to claim 27, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the nanoporous dielectric coating has a dielectric constant of from about 1.1 to about 3.5.

With regard to claim 28, the art does not show the stated monomethyl ethers of claim 1 and additionally further comprising the step, after step (b) and either before or after step (c), of treating the nanoporous dielectric coating with a surface modification agent under conditions sufficient to render the nanoporous dielectric coating hydrophobic.

With regard to claim 29, the art does not show the stated monomethyl ethers of claim 1 and additionally wherein the surface modification agent of claim 28 comprises hexamethyldisilazane.

The examiner has rejected claims 1-13 and 16-29 under 35 U.S.C. 103 over U.S. Patent No. 5,736,425 to Smith et al. (hereinafter '425) in view of Hawley's Condensed Chemical Dictionary. The crux of the examiner's position is that because Appellant's monomethyl **ethers** have a similar boiling point (as shown by Hawley) as the **glycols** of Smith, et al,

that the use of Appellants monomethyl ethers would be obvious over the Smith, et al references. Appellants submit that this is not the case. In the examiner's answer, he states that he believes the question at issue is "Would one of ordinary skill in light of the disclosure of Smith and the teaching of Hawley's produce the instant invention." First, Applicants urge that the examiner's proposed question is not the correct criterion to be used in deciding a case of prima facie obviousness. Second, Applicants submit that a question of prima facie obviousness should not be decided based on the examiner's subjective "belief".

MPEP section 2143 (v7 Rev.1) states that to successfully maintain an assertion that a claim is *prima facie* obvious,

...three basic criteria must be met. First, there must be some *suggestion or motivation*, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a *reasonable expectation of success*. Finally, the prior art reference (or references when combined) must teach or suggest *all of the claim limitations* (Italics added for emphasis). When the motivation to combine the teachings of the references is not immediately apparent, it is the duty of the examiner to explain why the combination of the teachings is proper. Ex parte Skinner, 2 USPQ2d 1788 (Bd. Pat. App. & Inter. 1986).

Applicants respectfully submit that the examiner has failed to meet the burden imposed by law. Neither of the references cited by the examiner, nor any other art made of record, provides any suggestion or motivation to use the specific monomethyl **ether** solvents required by the present invention. The examiner states that the '425 patent provides a list of *candidates* for low volatility solvents, thereby leaving anyone skilled in the art free to use the solvents required by the present invention. Applicants respectfully submit that the examiner's implication that any solvent having a similar boiling point would be suggested by Smith, et al does *not* qualify as adequate showing of a suggestion or

motivation by the cited reference. The examiner believes that because Hawley's lists diethylene glycol monomethyl ether as having a boiling point which falls within the range disclosed in the '425 patent, it would be obvious for one skilled in the art to use this substance in conjunction with the '425 patent. Appellants respectfully submit that the examiner is using an impermissible "obvious to try" standard of patentability. The fact that Hawley's lists diethylene glycol monomethyl ether as having a boiling point of 194°C does not give any suggestion or motivation *per se* to one skilled in the art which would lead them to formulate the present invention upon a combined reading with the '425 patent.

Appellants respectfully disagree with the examiner's interpretation of *Sinclair & Carroll Co v. Interchemical Corp*, 325 U.S. 327 (1945) to the present appeal. *Sinclair* involved the use of a solvent which had "the peculiar qualities of negligible vapor pressure at room temperature and high vapor pressure at 150 C" [325 U.S. 327, 333]. Arguably, *Sinclair's* solvent possessed distinct characteristics which one skilled in the art could use to predict success in conjunction with other components of the invention. In contrast, regarding the presently claimed invention, *Appellants urge that boiling points alone would not enable one skilled in the art to predict success in selecting one or more solvents for the siloxane precursor composition*. It is therefore submitted that one skilled in the art would not find any suggestion or motivation from the examiner's cited references to select these particular monomethyl ethers with any expectation of success.

The examiner also states that Appellants additionally listed non-monomethyl ethers as suitable solvents for the present invention. Appellants respectfully urge that this is irrelevant to the present appeal. The issue at hand relates to the presently claimed monomethyl ethers, which are not taught or suggested by the cited references.

Appellants also disagree with the examiner's interpretation of *United States v. Adams*, 383 U.S. 39 (1966) to the present appeal. *Adams* supports Appellants' position that because monomethyl ethers have specific functional properties related to the present

invention, it is irrelevant that they fall within the '425 patent's boiling point range. The monomethyl ethers of the present invention serve a specific purpose, unlike the solvent in *Sinclair* which served only as an inert carrier. Furthermore, Appellants contest the examiner's assertion that Appellants have admitted the absence of unexpected results in their Appeal Brief. Appellants again assert that there is no legal requirement that the claimed invention to be advantageous absent a *prima facie* showing that the claimed process would have been obvious. The examiner has jumped to the *assumption* that he has made a *prima facie* showing of obviousness in this case, which he has not.

The examiner asserts that because the '425 patent did not limit the solvents to glycols, and the '425 patent included the properties of boiling point and miscibility in both water and alcohol, that there is no distinguishing factor between '425 and the present invention. Appellants urge that this is simply not the case. The '425 patent only teaches **glycols**, they do not teach or suggest the use of a monomethyl **ether**. The examiner seeks to fill this gap by a showing from Hawley that diethylene glycol monomethyl ether has a boiling point of 194°C. However, the fact that ethylene glycol and diethylene glycol monomethyl ether may have similar boiling points and water miscibility is *insufficient* to suggest that ethylene glycol may be substituted by diethylene glycol monomethyl ether in Appellant's context. They are very different chemical entities which are *not* analogs, homologs or isomers of one another and the use of one does not suggest the use of the other to one skilled in the art.

The examiner states that Appellants still claim additional solvents in claims 16 and 20. Appellants submit that this fact is also irrelevant. The issue at hand is the non-obviousness of these claims requiring monomethyl **ethers**, not the optional presence of additional solvents in certain claims.

The examiner asserts that Appellant is seeking to take from the public that which '425 has given it. Appellants strongly disagree with this assertion. The present invention discloses novel processes which serve to benefit the public, not take away from them.

Appellants have already stressed the benefits of the present invention in previous papers, and it is submitted that Appellants have not confused any issues in the Appeal Brief, as the examiner suggests.

While the examiner again highlights his observation that other organic solvents besides monomethyl ethers are mentioned or even claimed in the present invention, Appellants wish to re-assert that this observation is *irrelevant* to the issue of obviousness. What *is* relevant is the fact that the presently claimed process requiring the recited monomethyl ethers is not taught or suggested by the references which the examiner has cited.

The examiner argues that the specification lists similar beneficial results as those named in the '425 patent. The examiner attempts to use this detail to support his assertion that the present invention has no unexpected properties which differ from the '425 patent. Applicants respectfully point out that the examiner must compare the present *claims* to the disclosure of the '425 patent.

The examiner has noted that Douglas M. Smith is listed as an inventor for the present invention as well as the '425 and '607 patents. The examiner suggests that this fact "strengthens the need" for Appellant to provide evidence of unexpected results, and states that Appellants "could have" easily distinguished the presently claimed invention from the prior art. Appellants submit that they *have* distinguished the presently claimed invention from the prior art, and that it is irrelevant to this particular obviousness issue that a common inventor is named. The fact of the matter is that the examiner has failed to present a legally sufficient *prima facie* case of obviousness in the first instance. No burden has shifted to Appellants to provide more.

In summary, the most fundamental difference is that di(ethylene)glycol monomethyl ether and the other solvents recited by claim 1 are **ethers**, thus placing them into a completely different class of compounds than the **glycols** or simple alcohols of the '425 patent. In addition, the monomethyl ethers as recited by claim 1 have only a single alcohol

functional group, in contrast to the double-alcohol or diol functional groups found in the glycols of the '425 patent. The present invention teaches away from Smith, et al. who advocate (at column 5, lines 35-40) the use of ethylene glycol for exchanging with ethoxy groups on the alkoxysilane. Such are believed to **undesirably crosslink** and produce a low storage stability composition as compared to the claimed ethers. Boiling point and water miscibility similarities are simply not sufficient to obviate the invention. For these and the foregoing reasons, Appellants respectfully urge that the 35 U.S.C. 103 rejection should be overruled.

The above arguments over are repeated and apply equally against the obviousness-type double patenting rejection. Appellants submit that because the references cited by the examiner fail to teach all elements of the presently claimed invention, namely, the claimed monomethyl ethers, the rejection of claims 1-13 and 16-29 under the judicially created doctrine of obviousness-type double patenting is improper and should be overruled.


Appellants respectfully submit that the above stated rejections should be overruled.

Respectfully submitted,



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I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage pre-paid in an envelope addressed to Assistant Commissioner for Patents, Washington, D.C. 20231, on October 12, 2000.



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